OFFSHORE OIL SPILL RESPONSE BASE AND MANAGEMENT OF DEEPWATER/OFFSHORE OIL RESOURCES IN THE NIGERIAN MARINE WATERS: A REVIEW

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ABSTRACT

Oil contributes to about 25% of GDP, 95% of annual foreign revenue and 65% of Nigeria's annual budgetary projections. Nigerian territorial waters and exclusive economic zone harbor over 30 offshore oil fields, 620 deepwater and offshore oil wells, leading to widespread oil exploration, exploitation and production activities. The recent widespread offshore and deepwater oil activities expose the marine waters and their ecosystems to potential risks of diverse degrees of oil spills which degrade the marine ecosystem services and function, as well as huge socio-economic loss to the nation. For instance, in 2011, a well blowout at the Shell Nigeria Petroleum Company Bonga Oilfield spilled about 40,000 barrels of oil into the Atlantic Ocean, which impacted coastal settlements, ground and surface water, fishing grounds and farmlands. This paper reports on the theoretical basis for Offshore Oil Spill Response Base in the context of published literature (secondary sources), conventions and conference/workshop resolutions, as well as reflecting on the inadequacies of the existing regulations to sufficiently address pollution in Nigerian marine waters and the Gulf of Guinea. Our study reveals the dominance of studies on causes, impacts, risks, vulnerability, prevention and remediation of oil spills, especially in onshore areas, with paucity of research on offshore oil spill preparedness, prevention, control and response, especially in developing contexts like Nigeria. This paper also outlines the basis for integrating Offshore Oil Spill Response Base into the management strategies for deepwater oil development to significantly minimize/respond to offshore oil spills, which will contribute to environmental sustainability of the Niger-Delta and the Guinea Current Large Marine Ecosystem towards realizing sustainable development goals 14 targets.

Keywords: Atlantic Ocean, Bonga Oilfield, GCLME, Gulf of Guinea, Niger-Delta, oil spills, sustainable development goal 14, territorial/marine environment.

1 INTRODUCTION

The discovery of oil in Nigeria at Oloibiri, Bayelsa State, in 1956 has created considerable socio-economic and investment opportunities for many multinationals and indigenous companies to engage in exploration and production activities, which earned the country the sixth-largest producer, Africa's largest producer and one of the world's largest exporters of oil. Nigeria's oil production capacity is estimated at over 2.5 million barrels per day [1]. It is estimated that Nigeria's oil reserves range from 24 billion to 31.5 billion barrels (OPEC), with 24% and 21% of the entire oil and condensates (denser liquid or solid formed as a result of conversion of a substance such as water from vapour state through a reduction in temperature of the vapour) reserve stored in offshore and deep offshore waters respectively (DPR, 2018 [2]. In other words, at least 45% of Nigeria's total oil wealth is located in the marine environment. The offshore waters stretch along the Atlantic Ocean from the territorial boundary or of Nigeria up to 200 nautical miles seaward. It is also known as marine waters. Majority of the oil reserves are found in relatively simple geological structures along

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the country's coastal Niger-Delta, but newer reserves have been discovered in deepwaters, offshore Nigeria (Fig. 1). The Niger-Delta is made up of the following nine states; Abia, Akwa Ibom, Bayelsa, Cross River, Delta, Edo, Imo, Ondo and Rivers [3] (Fig. 2). These newer oil reserves include more than 30 deepwater oilfields containing above 620 deepwater and offshore oil wells [4] and coupled with upcoming oil projects have potentially created major environmental management concerns in the biodiversity-rich Gulf of Guinea, which hosts most of these oil resources. The Gulf of Guinea coastline stretches across 21 countries in west, central and southern Africa with a total oil output of 127.5 million tons per day in 1980 and 174.6 million tons in 1996, accounting for about 4.0% of the world's total output in 1996 [5]. The Gulf of Guinea countries include Nigeria, Ghana, Togo, Benin, Cape Verde, Guinea, Equatorial Guinea, Cote d'Ivoire, Mauritania, Guinea Bissau, Liberia, Cameroun, Gabon, Democratic Republic of Congo, Republic of Congo, Sao Tome and Principe, Senegal, Sierra Leone, Angola, Namibia and South Africa. The sub-region's oil production has extended into offshore within the last decade with high concentration in Nigeria and Angola. This new development in the petroleum industry results in a gradual transition from onshore

Figure 1: Map showing some deepwater/offshore oil and gas fields located within the Nigerian exclusive economic zone (EEZ) in the Gulf of Guinea region of the Atlantic Ocean. OPL means Oil Prospecting License while OML means Oil Mining Lease. For instance, OMLs 72, 74, 77 and 79 are located within the Continental Shelf, while OMLs 120, 121 and 125 and OPLs 134, 118 and 135 are deepwater offshore fields and oil production areas located within the EEZ and Gulf of Guinea.
Source: Google search

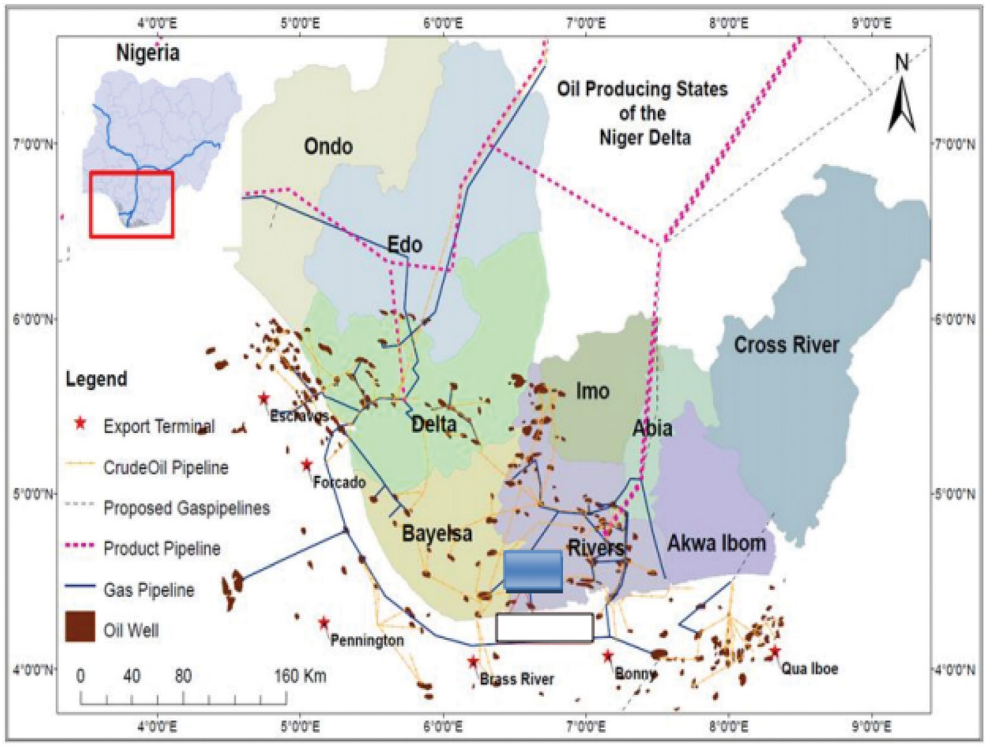

Figure 2: Map of the Niger-Delta, Nigeria showing the nine oil-producing states and the six offshore oil export terminals (Escravos, Forcados, Pennington, Brass, Bonny and Qua Iboe), where most of the major offshore oil spill incidents occurred. Source: Ja'afaru, W. S. and Cheng, Y. (2018). 'Generic Assessment Criteria for Human Health Risk Assessment of Petroleum Hydrocarbons in Niger Delta Region of Nigeria'. Journal of Environment Pollution and Human Health, vol. 6, no. 3: 110–120. DOI: 10.12691/jephh-6-3-4.

oil development activities to deepwater and offshore oil development with current and future consequences of coastal/marine environmental pollution resulting from oil spills. There are problems with the environmental performance on the oil platforms, and it is claimed, even by some oil company workers, that the environmental standards are far below those in the Gulf of Mexico. Though deep sea exploration and production activities contribute relatively small proportion of oil pollution in the marine environment [6], the widespread cumulative impact of exploration and production activities can generate a large proportion of oil spill over time. In the marine environment, oil spills can originate from natural seepage, wellhead blowout and tanker [7]. In addition, the OCEAN National Research Council of Canada categorized four sources of offshore oil discharge as mainly natural seepage while others include petroleum exploration, petroleum transportation and consumption [8].

The paper is a review on the incidences of deepwater/offshore oil spills in Nigeria's territorial waters in order to understand the extent, quantity, nature, impacts, risks and the state of research and knowledge of available response strategies used in managing the large-scale offshore/deepwater oil exploration and production activities in the Gulf of Guinea. The paper

also seeks to consider the future implications of Offshore Oil spill Response Base for the management of offshore oil development towards achieving sustainability of the Nigerian marine environment. The deepwater/offshore environment is considered a priority in this paper due to the following reasons: i) offshore production of oil lease condensate and hydrocarbon gas liquids is growing, accounting for nearly 30% of total global oil production in 2015 [9] and ii) oil exploration and production in the marine environments remain both complex and high risk as drilling operations explore global reserves in deep and ultra-deepwater locations [10–12]. The unpredictable character of marine environments escalates this complexity. iii) Both near-shore and open water spills are more difficult to contain, aggravating the exposure of communities and ecosystems situated near the spills and iv) Oil spills resulting from human activities in the marine environment are widely recognized as the most damaging type of spills [13], which require a more inclusive assessment of probable impacts and development of most effective intervention or contingency measures.

1.1 Overview of offshore oil spill incidents

The Niger-Delta has recorded several deepwater and offshore oil spills such as the Excravos Export Terminal equipment failure of 1978, which spilled about 300,000 barrels of oil into the Atlantic Ocean and polluted the coastal communities, ground and surface waters; Shell Petroleum Development Company's Forcados Export Terminal tank failure of 1978 spilled an estimated 580,000 barrels oil into the Atlantic Ocean, Texaco Offshore Funiwa-5 blowout incident of 1980 spilled about 400,000 barrels of oil into the Atlantic Ocean and the Brass River, Chevron Nigeria Funiwa-5 offshore station well blowout incident spilled an estimated 232,702 barrels of oil into the Atlantic Ocean, Brass River, coastal settlements ground and surface waters coupled with fishing grounds and farmlands (Table 1). A pipeline rupture at sea in 1998, also in Nigeria, resulted in an oil spill of 14,300 tons [14]. In 2010, the ExxonMobil pipeline supplying crude to Qua Iboe Export Terminal, Ibeno, Akwa Ibom State coastline ruptured and spilled an estimated 33,565 barrels of oil into the Atlantic Ocean, Delta Rivers, coastal settlements ground and surface waters, fishing grounds and farmlands (Table 1). In December 2011, a well blowout at the Shell Nigeria Petroleum Company Bonga oilfield spilled about 40,000 barrels into the Atlantic Ocean coastal settlements ground and surface waters, fishing grounds and farmlands. It was estimated that the Bonga oil spillage affected more than 168,000 individuals from 350 towns of the Nigerian Niger-Delta [15], coupled with direct damage in the form of pollution of the rich mangrove forest (encompassing 185 km of the length of Nigerian coastline), which provides 60% of fish breeding ground (Standing, 2008 [16]), and at the same time interrupted the means of living of approximately 28,000 fishermen fishing in that area [15]). According to Rev. Samuel Ayade, the coordinating Chairman of Akwa Ibom State and acting Chairman of the Niger-Delta Branch of Artisanal Fishers Association of Nigeria (ARFAN), the incident affected major fishing grounds and members of ARFAN, resulting in the deferment of fishing activities for a period of 9 months for the clean-up exercise to be carried out. The waiting time of no fishing severely affected the fishermen, whose means of livelihood and survival of their families depended on earnings from fishing. The severe economic situation was also exacerbated by the lack of payment for damages caused by the oil spillage [17]. Rev. Ayade further reported that the oil spillage affected the presence of the commonly occurring Bonga fish species, named after the Bonga oilfield. The sudden disappearance of Bonga fish species and non-eco-friendly cleaning activity after the oil spillage resulted to serious difficulty in catching the fish species.

Table 1: Summary of some reported major offshore oil spill in the Nigerian marine waters

S/N	Year	Source of oil spill	Quantity spilled (barrels)	Cause of spill	Polluted resources (impacted areas)
1	1978	Escravos export terminal (offshore)	300,000	Equipment failure	Atlantic Ocean coastal communities, ground and surface waters
2	1978	Forcados export terminal (offshore)	580,000	Tank failure	Atlantic Ocean coastal communities, ground and surface waters
3	1980	Texaco offshore Funiwa Oilfield	400,000	Well blowout	Atlantic Ocean and Brass River
4	1980	Chevron Nigeria Funiwa 5 offshore station	232,702	Well blowout	Atlantic Ocean, Brass River, coastal communities, ground and surface waters, fishing grounds and farmlands
5	2010	ExxonMobil pipeline to Qua Iboe Terminal, Ibeno (offshore)	33,565 (1 million gallons)	Pipeline rupture	Atlantic Ocean, delta rivers, coastal settlements, ground and surface waters, fishing grounds and farmlands
6	2011	Shell Nigeria Petroleum Company Bonga oilfield (offshore)	40,000	Well blowout	Atlantic Ocean, coastal settlements, ground and surface waters, fishing grounds and farmlands
7	2014	Cumulative report of oil spill in Akwa Ibom State	300,000	Equipment failure and sabotage	Inland waters (rivers, lakes, lagoons etc.)

Source: Authors compilation from literatures

Furthermore, Rev. Ayade remarked, thus 'There is hunger in the fishing communities, there is no fuel subsidy from the government, our effort to survive is threatened by pollution. Fishing is the only thing we know. The Bonga fish that is common in our region throughout the year is now impossible to catch due to the oil spillage. Rather than execute an effective clean-up, the company used chemicals to sink the oil, which leads to further damage to the surviving species. As I speak to you, we don't even see Bonga fish to catch as much as we used to, which is why some fishermen are turning to crayfish' [17]). Beyond the impact of the Bonga oil spillage on the resident fish species, the incident caused significant loss of revenue, resulting in economic impoverishment, food shortage, sicknesses, and truncation of children's schooling [15]. It has also been observed that due to the severe impacts of oil spillage in the Niger-Delta, especially the problem of revenue loss and loss of means of livelihood, a considerable number of former fishermen and farmers joined one of the most active revolutionary group to make money from hostage-taking and other illicit oil transactions, as alternative means of survival [18, 19]). On a global scale, the incident constitutes serious impediment to the actualization of the UN sustainable development goals (SDGs), particularly, SDG 14, focused on 'sustainable use of the sea, marine and ocean resources', which already has been under the threat of illegal, unregulated and unreported fishing by international/money-making vessels [19]. Also, in January 2012, fire outbreak from Chevron's Funiwa offshore Gas depot caused a huge spill in Brass and Bonny rivers (Table 1). One of the Nigeria's largest offshore spills was a well blowout, which occurred in January 1980 when an estimated 200,000 barrels of oil (8.4 million US gallons) spilled into the Atlantic Ocean, destroying 340 hectares of mangrove [20]. The Idoho oil spill travelled all the way from Akwa Ibom State to Lagos State, dispersing oil through the coastal states up to the Lagos coast. This culminated in the presence of oil sheen on the coastal areas, which impacted the adjoining coastal waters of seven states, namely, Cross River, Akwa Ibom, Rivers, Bayelsa, Delta, Ondo and Lagos States. The impact of oil spill in the Nigeria coastal environment has also degraded the mangrove ecosystem, which was once rich in fuelwoods and biodiversity, but is now unable to survive the oil toxicity due to the reoccurrence of oil spills in recent times [21].

On the other hand, in the maritime domain, other incidences of oil spill result from economic sabotage involving the breaking of offshore oil pipelines to steal oil, usually perpetrated by criminal elements operating within the territorial waters of the country. These illicit maritime activities result in widespread marine oil spills with difficulty associated with incident source identification and inventorization, since they use unregistered and unknown vessels. On a global scale, [22] reported that shipping activities involving oil transportation result in the release of about 600,000–1,750,000 tons of oil into the ocean yearly, while [23] corroborated that the shipping industry is the main oil polluting agent in the marine waters, thereby categorizing it as a 'polluting industry'. According to [24], between 2010 and 2014, 5000 tons of the average of 10,000 billion tons of crude oil transported by sea annually was spilled as a result of marine accidents, cleaning operations or other sources. For instance, ballast tanks washing generates 36,000 metric tons (11.2 million gallons) of oil released annually into the oceans globally; anthropogenic activities and non-tank vessels [25].

In many communities located near oil installations in the Niger-Delta, even when no recent spill occurred, oily sheen can be seen on water, including freshwater, which people depend on for drinking, cooking and washing. Water samples from Luawii, in Ogoni, where there had been no oil production for 26 years (since 1993), had 18 ppm of hydrocarbons in the water, 360 times higher than the European Union (E.U.) permissible limit of pollutants in drinking water. Another sample from Ukpeleide, Ikwerre, contained 34 ppm, 680 times the E.U.

standard. Over the years, efforts made towards the management of environmental impacts of oil exploration and production in Nigeria include, among others, enactment of regulatory/ legislative framework, standard operating procedures, institutional frameworks and environmental policies. For instance, the National Oil Spill Contingency Plan (NOSCP, revised 2013) provides for contingency planning to assess risks, appropriate remedial actions to be taken in event of a spill, training of response personnel, procedures for reviewing and testing of response capabilities. It also supports timely and effective deployment of personnel and equipment to respond to oil spills, as well as tests communication effectiveness with relevant stakeholders, namely, host communities, media, nearby oil industry operators etc. This scenario typifies the response plan during large-scale oil spills (Tier-3, above 5000 barrels in coastal/marine waters and above 250 barrels in inland waters), which requires multi-stakeholder intervention. However, presently, there is no Tier-3 response infrastructure (or Stockpile) for both inland and offshore oil spills in Nigeria, especially for offshore and deepwater oilfields in the biodiversity-rich and oil-rich Gulf of Guinea.

Many researchers have studied the short and long-term harmful effects of marine/coastal oil spills on the mortality rate, feeding, reproduction and predator avoidance behaviour of fish population [26, 27], estuarine populations, mammals, birds and turtles [28, 29], deepwater corals [30], planktons [31], foraminifera [32] and microbial populations [33], as well as quantifying risks in order to understand potential and laboratory-based findings of ecological, environmental, socio-economic, cultural and epidemiological implications of disastrous oil spills. However, little or no studies have considered the implications of establishing deepwater/offshore oil spill response base as contingency planning to facilitate the rapid mobilization and deployment of manpower and equipment necessary to undertake and support emergency response operations. Furthermore, studies have shown bioremediation and use of dispersants to break down and disperse oil respectively as appropriate remedial and response measures in marine/coastal oil spills. For instance, in the Nigerian coastal waters, dispersants use is restricted to water depths of 20m and 5 km distance from the shoreline for Tiers 1–3 oil pollutions. This strategy is limited in application because remediation and dispersant use constitute response options used on case-by-case basis and part of response procedures that do not apply in all oil spill incidents.

1.2 Materials and Methods

This paper adopted a systematic literature review including above 40 academic journal articles, government environmental policies, published reports from reputable international, regional and local organizations, relevant environment-based guidelines and regulations concerning deepwater/offshore oil spills, their environmental and socio-economic impacts, including cultural and epidemiological implications [34]. Some of the literature reported different previous incidences of deepwater/offshore oil spills in the Nigerian territorial waters and the impacted media, as well as quantifying/estimating the volume or barrels of oil spilled into the waters and its consequences on the wildlife. Other literature revealed case studies of offshore oil spills on regional and global bio-geographical locations chronicling some major oil spill incidents such as 1978 Amoco Cadiz oil spill offshore of Brittany, France; the 1989 Exxon Valdez oil spill in Prince William Sound, Alaska; the 1999 Erika oil spill off the coast of Brittany; the 2002 Prestige oil spill offshore of Spain and Portugal; the 2007 MT Hebei Spirit oil spill in South Korea; the 2010 BP Deepwater Horizon oil spill, caused by an explosion on an offshore drilling platform; and British spills including the 1993 Braer

and 1996 Sea Empress spills. The insight provided in these resources revealed the current dearth of empirical evidence and studies on technologies and engineering infrastructures for oil spill response in Nigeria and globally. This scenario suggested the development of new technologies and methodologies for mitigating deepwater/offshore oil spills in order to achieve sustainable contingency planning system, optimum preparedness and response strategy that can effectively facilitate rapid mobilization and deployment of personnel and equipment necessary to carry out and support oil spill emergency response operations. The deepwater/offshore oil spill response base is considered as national contingency planning and response strategy to facilitate long-term and on-site sound decision-making for response and countermeasures.

2 CONCEPTUAL AND THEORETICAL FRAMEWORKS

The rising rate of offshore oil operations globally underpins the need for the implementation of contingency planning regime for responding to or managing offshore oil spill emergencies in the marine or coastal waters of oil-producing nations/states. This contingency planning strategy can be considerably linked to Drivers-Pressures-State-Impact-Response (DPSIR) Framework/Model [35–37], an integrated, adaptive management concept whose conceptual applicability can be inter-disciplinarily defined [38]. Recent researches have given specific attention to the application of DPSIR model and its derivatives in the coastal and marine environment [39-40]. In the marine environmental management context, DPSIR can be integrated into the offshore oil spill contingency planning strategy where D is anthropogenic activities (i.e. offshore/deepwater exploration and production), P is causes of the problem (i.e. oil spills), S is state changes (i.e. coastal/marine pollution), I is impact types (human, socio-economic and environmental) and R is human response (in this case offshore oil spill emergency response facility). Another theoretical framework upon which the offshore oil spill response base is hinged on is the approach developed by [41–42], which recommended the development of new strategies for effective and integrated decision-making frameworks and systems that support oil spill response. In applying this framework, a study by [43] observed the effectiveness of strategies that support long-term and on-site specialized decision-making for offshore oil spill response and countermeasures, which the offshore oil spill response base fits.

In the USA, for example, the operational framework for oil spill integrates the federal, state and international bodies with dual responsibility plan, namely i) oil spill response and clean-up and ii) oil spill prevention/preparedness. For offshore spills, the US Coast Guards takes responsibility for response. Within the US operational framework for oil spill management is the Oil Spill Risk Analysis (OSRA) undertaken by the US Department of Interior Bureau of Ocean energy Management (BOEM) to make available oil spill baseline data capable of simulating probabilistic scenarios that can be used for ecological analysis or response forecast. OSRA originated from [44] and improved by Minerals Management Services (MMS) in the recent past [45–47] as a model for presenting a reverse semblance of transport and direction of oil spillage through existing baseline data on time (e.g. seasons of the year) and place-based (e.g. geographic locations at sea) winds and ocean currents regime within a particular area, e.g. Gulf of Mexico. The OSRA framework operates on the principle of estimating the probable incident of large-scale oil spillage (≥1000 barrels) resulting from offshore oil and gas exploration, exploitation, production, disengagement of oil facilities from service and shipping, affecting or reaching sensitive offshore and onshore environmental resources or areas. Essentially, OSRA is generally carried out based on three-dimensional possibilities/

objectives associated to the problem of oil spillage, namely i) estimating the probable incident of large-scale oil spill occurring, ii) the pathways of the course along which oil spill from speculative spill sites move towards sensitive offshore and onshore environmental resources or areas, and iii) applying (a) and (b) to approximately calculate the entire oil spill threats of incidence of huge oil spill and resources or areas to be possibly affected should there be oil development and production activities [48]. OSRA is modelled to serve as 'hazard-based' and 'risk-based' evaluation of the probability of large-scale oil spill occurring despite their high or low chance occurrence [48]. While hazard-based evaluation corresponds with OSRA objective (i) above (i.e. estimating the probable incident of large-scale oil spill occurring) irrespective of their probabilities, risk-based evaluation is concerned with the probabilities of oil spill incident happening or the proposed remedial actions for minimizing the likely consequences of the spillage. In essence, while hazard-based OSRA is based on precautionary principle aimed at preventive and preparedness objectives, risk-based OSRA is response, remedial and restoration driven. The foregoing discourse suggests a point of convergence or consistency between the main objective of offshore/deepwater oil spill response base and the objective of 'risk-based' OSRA, which is designed to serve as oil spill response, remedial and restoration infrastructure. Functionally, OSRA hazard-based and risk-based models have been deployed successfully by the US government in building preventive and preparedness capacities for oil and gas fields within the Outer Continental Shelf (OCS), leased out to companies in offshore areas such as Beaufort Sea Planning Area, Eastern Planning Area, Central Planning Area and Western Planning Area of the Gulf of Guinea (2017–2022) [49], as well as the Walker Ridge Planning Area [50] located around the offshore waters of the Gulf of Guinea and Cook Inlet Planning Area consisting 16 offshore margin sections and the Cook Inlet, Kodiak, Alaska Peninsula and Gulf of Alaska shoreline [51].

In the UK, response strategy for offshore installations and ship-generated marine pollution is coordinated by the National Contingency Plan [52] while the Maritime and Coast Guard Agency takes charge of major oil spill preparedness [53–54]. Technical and operational response in the Norwegian offshore is coordinated by the Petroleum Safety Authority, while the National Oil Spill Contingency System is the standardized framework for coordinating response plans involving federal, municipal and industry operators [55]. The Transport Canada, in 2010, developed plan and policy for oil spill preparedness and response with the main target of establishing Canadian Marine Oil spill, Preparedness and Response Regime, indicating the functions of all sectors in event of offshore oil spill including Transport Canada, the Canadian Coast Guard, the Environment Canada, registered response bodies, response vessels, response facilities, etc. [56]. This was later upgraded in 2011 to the National Environmental Response Strategy for responding to disastrous offshore oil spill of national and international magnitude [57]. In Australia, the Australia Marine Oil Spill Centre is responsible for deepwater/offshore oil spill response [58]. The Saudi Arabian National Contingency Plan for Combating Marine Environmental Pollution by Oil and other Harmful Substances was endorsed in 1991. As a contingency mechanism for combating offshore oil spill from at least two marine tanker accidents per year, with each incident discharging about 550 tons of oil into the marine environment, the Chinese government accorded high priority to the protection of marine environment by initiating an 11th 5-year Plan by constructing above 20 oil spill emergency equipment libraries in high-risk areas on the coast and along the shoreline of Yangtze River. The International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC) was endorsed by the International Maritime Organization (IMO) in 1989 for combating oil pollution nationally and in cooperation with other countries [59–60].

From the diverse regional and national perspectives highlighted, the key objective of oil spill contingency planning includes, among others, a system that facilitates the rapid mobilization and effective deployment of personnel and equipment necessary to implement emergency response operations, of which the Offshore Oil Spill Response Base fits in. In a nutshell, the rationale behind offshore oil spill contingency planning framework is emergency response operations facility (in this case, offshore-based oil spill response facility) for responding promptly and effectively to oil spills. Oil spill response can be described as a hazardous exercise involving mobilization, deployment, control/containment, clean-up and recovery of oil using personnel and equipment with the main purpose of minimizing damage and time of recovery from the environment (in this case, marine/coastal waters). The complex nature of deepwater/offshore oil spill response prompted the development of diverse contingency planning measures/models, usually influenced by the characteristics of the affected environment. The IMO [61] initiated 'a whole operation scheduling scheme of marine oil spill emergency vessels that followed the characteristics of marine oil spill emergency disposal environment, and the requirements for emergency vessel scheduling, by integrating the Electronic Navigational Charts (ENC), Global Positioning System (GPS), Automatic Identification System (AIS), wireless network, and oil spill monitoring technologies, to improve the capacity of marine oil spill disposal'. The contingency planning and response models highlighted in this paper suggest the need for more effective and timely prioritization of coastal/marine environment protection in the Nigerian territorial/offshore and deepwater oil facilities and activities, as well as the entire Gulf of Guinea, considering the high proportion of deepwater oil exploration in the west, central and South Africa region. The Nigerian NOSCP formulated in 1993, reviewed in 1997, 2010 and subsequently in 2013, signalled a demonstration of the Nigeria government's commitment to combat oil spill and associated environmental challenges in accordance to the OPRC, 1990, which the country has ratified. Article 6 of OPRC states that 'each party shall require that operations of offshore units under its jurisdiction have oil pollution emergency plans, which are coordinated with the national system approved in accordance with procedures established by the competent national authority'. The Convention also provides that 'each party shall require that authorities or operators in charge of such seaports and oil handling facilities under its jurisdiction as it deems appropriate should have oil pollution emergency plans or similar arrangements, which are coordinated with the national system approved in accordance with procedures established by the competent national authority'. The domestication of the OPRC, 1990 in Nigeria and establishment of the National Oil Spill Detection and Response Agency (NOSDRA) in 2006 provide the operational and governance/institutional frameworks for operationalization of the NOSCP and IMO requirements for national and regional action to prevent, control, combat and mitigate marine pollution and to promote technical cooperation.

3 DISCUSSION

Globally, oil and gas exploration and production is regular in many offshore environments, with major deepwater (>200m) production in areas such as the Arctic, northern North Atlantic Ocean (UK and Norwegian waters), East and West Africa (Gulf of Guinea), Gulf of Mexico, South America, India, Southeast Asia, and Australia. There is also an emerging awareness of the social and economic costs of the failure to manage marine ecosystems in a sustainable manner. For instance, the Deepwater Horizon oil spill disaster occurred on April 20, 2010, as a result of well blowout at the Macondo oil well, off the coast of Louisiana, USA, resulted in the suspension of deepwater drilling activities in the Gulf of Mexico and the consequent

migration from the Gulf of Mexico to other oil fields around the world, particularly in the West African territorial waters. In Nigeria, over-exploitation of onshore oil wells with associated fragile security and safety concerns have created great incentive for oil industry operators to re-direct their operations to deepwater and offshore oil fields. Evidences from reviewed literature and theoretical frameworks at regional, national and local bioregions suggest an imperative for a holistic marine/coastal environment management plan to integrate offshore/deepwater oil spill emergency response system into the oil spill contingency plan, under which the offshore oil spill response base can be considered. The integration of the Large Marine Ecosystem into a realistic approach to the protection of the Gulf of Guinea marine environment has two-fold objectives of combating marine pollution by offshore operations and preventing the reduction of marine wildlife through the extraction of natural resources. These objectives are consistent with the contingency plan regimes and offshore/marine oil spill response strategies developed and implemented by many industrialized countries, e.g. USA, UK, Canada and China, in compliance with the OPRC, 1990 requirements/provisions, which Nigeria has adopted alongside other conventions such as 1972 Convention on the Prevention of Marine Pollution by the Dumping of wastes and other matters (ratified in 1977), International Convention for the Prevention of Pollution from ships, 1973, as modified by the protocol of 1978 and Convention for cooperation in the Protection and Development of the Marine and Coastal Environment of the West and Central African Region (signed 23 March 1981). The domestication of these international conventions and protocols in Nigeria indicates that there is a clear, favourable and seamless regulatory environment that promotes offshore oil spill emergency response facilities to sustainably manage hundreds of offshore/deepwater oil fields and installations in the Nigeria territorial waters and the Gulf of Guinea for the sustainability of the marine/coastal environment.

On the global context, the United Nations World Summit on Sustainable Development (WSSD) at both 'Earth Summit' in Rio de Janeiro in June 1992 and Johannesburg in 2002 recommended the integration of protection of the marine environment into the plans for oil and gas exploitation in the context of National Strategies to be implemented mainly by coastal states, which also include Nigeria and other countries in the Guinea Current Large Marine Ecosystem (GCLME) region. Within the framework of the WSSD plan of action, the environmental management strategies for the protection of the marine/coastal environment includes among others, conservation of biological diversity, protection and management of oceans and protecting and managing freshwater. The United Nations Guiding Principles on Human Environment, 1972 provides two principles relevant to the proposed project, which include Principle 6 that prescribed thus, 'the discharge of toxic substances or other substances and the release of heat, in such quantities or concentrations as to exceed the capacity of the environment to render them harmless, must be halted in order to avoid serious or irreversible damage upon the ecosystems' and Principle 7 which emphasized that 'states shall take all possible steps to prevent pollution of the seas by substances that are liable to create hazards to human health, to harm living resources and marine life, to damage amenities or to interfere with other legitimate uses of the sea'. Furthermore, paragraph 33 of the 2002 World Summit on Sustainable Development (Agenda 21 of WSSD) provides for enhanced maritime safety and protection of the marine environment from pollution by actions at all levels to among others, invite states to ratify or accede to and implement the conventions and protocols and other relevant instruments of the IMO relating to the enhancement of maritime safety and protection of the marine environment from marine pollution and environmental damage caused by ships, including the use of toxic antifouling paints and urge IMO to consider stronger mechanisms

to secure the implementation of IMO instruments by flag States. The WSSD requirements, particularly paragraph 33 of Agenda 21 of WSSD suggest an interrelationship between the objectives of the IMO OPRC, 1990, which is the framework for the implementation of the NOSCP for Nigeria. It is within this framework that the offshore/marine oil spill response base can be considered for the enhancement of maritime safety and protection of the marine environment in order to sustain oil exploration and production in a responsible manner.

Component 'C' of the IMO and International Petroleum Industry Environmental Conservation Association (IPIECA) Guidelines under the Global Initiative for West, Central and Southern Africa (GI-WACAF) urged all member states to provide resources for oil spill response. GI-WACAF is a partnership between IMO and IPIECA, as well as oil and gas industry association for environment and social issues launched in Cape Town, South Africa in 1996. The GI-WACAF Conference hosted in Abuja, Nigeria, in December 2006 by the National Oil Spill Detection and Response Agency (NOSDRA) in collaboration with IPIECA and IMO recommended that Nigeria should set up an oil spill preparedness and response system. Furthermore, Annex 5 (Section 5, Sub-section vi and x) of the communiqué issued at the 2006 Conference of representatives of 22 member states of GI-WACAF held in Abuja, Nigeria, also urged 'NOSDRA (Nigeria government) to ensure there is sufficient and appropriate stockpiles of oil spill response equipment for the respective tiered response systems and these should be located in strategic positions' and 'NOSDRA (Nigerian government) should establish a National Oil Spill Response Centre equipped with appropriate communication, including National Emergency telephone numbers', respectively. For instance, it may be recalled that during the Bonga offshore/deepwater oil spill in 2011, Nigeria called in resources from the Oil Spill Response Limited, Southampton, UK, to assist in combating the Tier-3 oil spill. This situation poses serious threats to the rich, fragile marine biodiversity during marine oil spill as delay in response time could cause high scale damage and degradation of the marine ecosystems. Establishment of deepwater/offshore oil spill response in Nigeria territorial waters can contribute to mitigating the current and potential environmental and socio-economic threats posed by increasing the rate of offshore/deepwater oil exploration and production activities in the Nigeria territorial waters and the Gulf of Guinea. More so, the recommendations above suggest a correlation between the requirements for stockpiling appropriate oil spill response equipment for different levels of response at strategic locations and establishment of deepwater/offshore oil spill response base.

4 CONCLUSION

The establishment of Offshore Oil Spill Response Base (regional spill response centre) along coastlines will help in managing deepwater/offshore oil spill problems [62]. Consequently, offshore oil spill response base for the management of offshore/deepwater oil development in the Nigeria territorial waters/marine environment and Gulf of Guinea/GCLME region will contribute to sustainable socio-economic and environmental management outcomes in the following ways:

i) Significant reduction in oil spill emergency response operational cost for oil companies since the huge economic burden of acquiring very expensive Tier-3 equipment individually will now be alleviated by the proposed project;
ii) Enhanced regional/national capacity for the management of major marine oil spill incidents from offshore/deepwater exploration and production;

iii) Provide infrastructural development in the oil and gas industry to assist Nigeria and GCLME countries to operate in line with international best practices regarding international laws and conventions on the protection of the marine environment;
iv) Minimize the socio-economic losses incurred by the oil-bearing communities as a consequence of the devastating impact of oil spill on their means of livelihood, e.g. fishing grounds, source of drinking water, farmlands, etc.;
v) Safeguard the marine biodiversity from the impact of oil pollution, thereby ensuring ecosystem protection and sustenance;
vi) Enhanced corporate social responsibility for the oil companies as the huge resources lost on management of oil pollution is now channelled to the provision of social amenities, namely health centres, schools, portable water supply, electricity, etc., to the oil-bearing communities;
vii) Promote healthy, safe and secure environment for oil exploration and production, thereby enhancing revenue generation for Nigeria and other GCLME countries, as well as stable business environment in the oil and gas industry;
viii) Generate employment and economic opportunities for the oil-bearing communities in line with the Nigeria Local Content Law, thereby improving their standard of living and reducing youth restiveness, as well as preventing hostilities/acts of sabotage; and
ix) Improve the health conditions of oil-bearing communities whose health has been consistently impaired by the consumption of contaminated seafood, seawater, groundwater, etc.

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